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ABSTRACT

Developed by the ABCs of Construction National Workplace Literacy Project, these curriculum materials for the occupational area of millwright contain a lesson that deals with problem solving using charts and tables. The lesson consists of an objective, instruction, and eight exercises. The objective for the lesson is for the student to learn to use charts to solve problems. The problems found in the 10 exercises accompany the tables in a companion manual, "Reading Charts and Tables. Millwrights." (YLB)

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ED 374 299

TECHNICAL DEVELOPMENT CENTER

Problem Solving

using

Charts and Graphs

Millwright

U.S. DEPARTMENT OF EDUCATION
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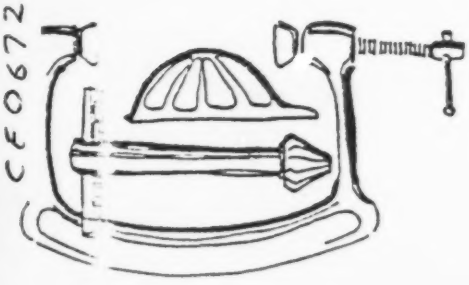

Associated Builders & Contractors, Inc.
EBR Adult & Continuing Education

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ABC's of Construction

National Demonstration Project in Workforce Literacy

The ABC's of Construction Project was funded in 1991 by the U.S. Department of Education as a grantee through the National Workplace Literacy Program (PR #198A10155). The program provided basic skills instruction to industrial construction workers employed by companies which are members of the Pelican Chapter of Associated Builders and Contractors (ABC). Located in Baton Rouge, Louisiana, ABC provides training to employees of over 60 member companies who perform contract work in the 58 petrochemical facilities located along the Mississippi River between Baton Rouge and New Orleans.

The grantee, the Adult Education Department of East Baton Rouge School Board, performed a comprehensive literacy task analysis of the apprenticeship training program for millwrights, pipefitters, electricians, instrumentation techs, and welders involved in the ABC training program. Over 20 modules of original, contextual curriculum were developed to teach the reading and math skills required for success in the craft training program.

Materials developed for instruction incorporated cognitive strategies for learning basic skills in the context of the craft and safety knowledge demanded by the industrial construction workplace. Instruction was written for a competency-based, open-entry/open-exit, individualized adult learning program that operated at the ABC training center in the evenings after work-hours.

SOLVING PROBLEMS WITH CHARTS AND TABLES

OBJECTIVE: You will learn to use charts to solve problems.

Tom works for EZ Build Construction Company. He is an electrician. He has six months experience. He works 40 hours per week. He makes $520 per week. He wants to apply at Bigbucks Construction Company. But which job pays more? And how much more? He uses the following chart:

BIGBUCKS CONSTRUCTION COMPANY

PAY SCHEDULE

	Laborer	Mill-wright	Electrician	Heavy Equipment Operator	Pipe-Fitter
EXPERIENCE < 1 year (base)	$10.00	$16.00	$9.50	$11.50	$5.00
2-5 years (base + 25%) more than	$10.00 +2.50	$16.00 +4.00	$8.00 +2.00	$12.00 +3.00	$5.00 +1.25
5 years (base + 50%)	$10.00 +5.00	$16.00 +8.00	$8.00 +4.00	$12.00 +6.00	$5.00 +2.50

Sometimes looking up information on a chart doesn't give you the answer you need. But you can use that information to find what you need. How do you do that?

You need to be able to do five things:

(1) Identify the question you want to answer.
(2) Decide what operation(s) (addition, subtraction, multiplication, division) you need to use.
(3) Find what you need from the chart.
(4) Plug the information into your operations.
(5) Work the problems.

Look at Tom's problem again.

Tom works for EZ Build Construction Company. He is an electrician. He has six months experience. He works 40 hours per week. He makes $520 per week. He wants to apply at Bigbucks Construction Company. But which job pays more? And how much more?

What is the question he wants to answer? He wants to know who pays more: his company or another company.

What operation(s) does he need? Tom knows the chart shows hourly rates. He wants to know how much he would make in a 40-hour week. He must multiply the rate by 40. Then, he will subtract that amount from his current weekly wage.

What information does he need from the chart? He needs the rate of pay for an electrician with less than 1 year experience. That is $16.00.

Plug the information into the problem. $16 X 40 = weekly wage at Bigbucks. Weekly wage at Bigbucks - $520 = difference.

Work the problem. 40 hours per week X $16 per hour = $640 for a week at Bigbucks. $640 (at Bigbucks)- $520 (at EZ Build) = $120. Tom would make $120 more at Bigbucks.

Now Tom has the answer. There is one more step he should follow. This step is "Does that make sense?" Some people think that using a calculator always gives them the right answer. This is only true when you put the right numbers into the calculator. Only you can determine if the answer seems right based on your experiences.

The following problems accompany the tables in READING CHARTS AND TABLES--MILLWRIGHTS.

EXERCISE 1 Lathe Cutting Speeds

1. **Charlie is using aluminum. What is the difference in surface feet per minute for roughing and finishing cuts?**

What is the question? _____

What operation (s) is needed? _____

_____

What information do you need from the chart?

_____

Plug in the values. _____

Work the problem _____

Does it seem correct? _____

How do you know?

_____

2. Charlie is cutting alloy steel. He wants to make a roughing cut. He has 300 feet to cut. How long should it take for the slowest cutting speed?

What is the question? _____

What operation (s) is needed? _____

_____

What information do you need from the chart?

_____

Plug in the values. _____

Work the problem _____

Does it seem correct? _____

How do you know?

_____

3. Charlie compares cutting hard and soft cast iron. What is the difference in cutting speeds? He wants a finishing cut in meters per minute.

What is the question? _____

What operation (s) is needed? _____

_____

What information do you need from the chart?

_____

Plug in the values. _____

Work the problem _____

Does it seem correct? _____

How do you know?

_____

4. **Charlie is cutting mild steel and medium carbon steel. What is the difference in lathe cutting speeds? He wants a roughing cut figured in meters per minute.**

What is the question? _____

What operation (s) is needed? _____

_____

What information do you need from the chart?

_____

Plug in the values. _____

Work the problem _____

Does it seem correct? _____

How do you know?

_____

5. **Charlie is in a hurry. He will use the fastest possible speed. He has to make 1000 feet of aluminum. He must make a finishing cut. How long will it take?**

What is the question? _____

What operation (s) is needed? _____

_____

What information do you need from the chart?

_____

Plug in the values. _____

Work the problem _____

Does it seem correct? _____

How do you know?

_____

6. **Charlie is cutting bronze. He compares the roughing and finishing cuts in meters per minute. What is the difference?**

What is the question? _____

What operation (s) is needed? _____

_____

What information do you need from the chart?

_____

Plug in the values. _____

Work the problem _____

Does it seem correct? _____

How do you know?

_____

7. Charlie has brass and bronze. He must making roughing cuts in each. What is the difference in surface feet per minute?

What is the question? _____

What operation (s) is needed? _____

_____

What information do you need from the chart?

_____

Plug in the values. _____

Work the problem _____

Does it seem correct? _____

How do you know?

_____

8. Charlie has 100 feet of high carbon steel. He wants to make a roughing cut. He will use the slowest speed. How many seconds will it take?

What is the question? _____

What operation (s) is needed? _____

_____

What information do you need from the chart?

_____

Plug in the values. _____

Work the problem _____

Does it seem correct? _____

How do you know?

_____

9. **Charlie has 120 feet of free-turning brass. He is making a roughing cut. How many minutes will it take at the fastest speed?**

What is the question? _____

What operation (s) is needed? _____

_____

What information do you need from the chart?

_____

Plug in the values. _____

Work the problem _____

Does it seem correct? _____

How do you know?

_____

10. Charlie compares roughing cuts for bronze and alloy steel. What is the difference in meters per minute?

What is the question? _____

What operation (s) is needed? _____

_____

What information do you need from the chart?

_____

Plug in the values. _____

Work the problem _____

Does it seem correct? _____

How do you know?

_____

EXERCISE #2 Charlie, Lathe Cutting Speeds

1. **Charlie is checking feed rates. A worker is cutting alloy steel. He is making a roughing cut. His rate is 0.0025 inches. What is the difference between that amount and the deepest correct feed rate?**

What is the question? _____

What operation (s) is needed? _____

_____

What information do you need from the chart?

_____

Plug in the values. _____

Work the problem _____

Does it seem correct? _____

How do you know?

_____

2. Charlie must cut free-turning brass and bronze. He will make finishing cuts. What is the difference between the feed rates in millimeters?

What is the question? _____

What operation (s) is needed? _____

_____

What information do you need from the chart?

_____

Plug in the values. _____

Work the problem _____

Does it seem correct? _____

How do you know?

_____

3. Charlie is using medium carbon steel. He is making roughing cuts. He wants to convert the rates into fractions. What would that be expressed in fractional amounts?

What is the question? _____

What operation (s) is needed? _____

_____

What information do you need from the chart?

_____

Plug in the values. _____

Work the problem _____

Does it seem correct? _____

How do you know?

_____

4. **Charlie is using alloy steel. He compares feed rates for roughing cuts and finishing cuts in millimeters. What is the difference?**

What is the question? _____

What operation (s) is needed? _____

_____

What information do you need from the chart?

_____

Plug in the values. _____

Work the problem _____

Does it seem correct? _____

How do you know?

_____

5. Charlie is making a special cut. He is using bronze. He must double the deepest finishing cut. What would the depth be?

What is the question? _____

What operation (s) is needed? _____

_____

What information do you need from the chart?

_____

Plug in the values. _____

Work the problem _____

Does it seem correct? _____

How do you know?

_____

6. Charlie is using aluminum and soft cast iron. He is making a finishing cut. What is the different in the depths for the feed rates in millimeters?

What is the question? _____

What operation (s) is needed? _____

_____

What information do you need from the chart?

_____

Plug in the values. _____

Work the problem _____

Does it seem correct? _____

How do you know?

_____

7. Charlie made a 3/4 inch roughing cut. He was using hard cast iron. What is the difference between that amount and the largest feed rate he should have used?

What is the question? _____

What operation (s) is needed? _____

_____

What information do you need from the chart?

_____

Plug in the values. _____

Work the problem _____

Does it seem correct? _____

How do you know?

_____

8. **Charlie compares finishing cuts. He is using bronze and soft cast iron. What is the difference in inches?**

What is the question? _____

What operation (s) is needed? _____

_____

What information do you need from the chart?

_____

Plug in the values. _____

Work the problem _____

Does it seem correct? _____

How do you know?

_____

9. Charlie has hard and soft cast iron. What is the difference in their roughing cuts in millimeters?

What is the question? _____

What operation (s) is needed? _____

_____

What information do you need from the chart?

_____

Plug in the values. _____

Work the problem _____

Does it seem correct? _____

How do you know?

_____

10. Charlie has alloy and medium carbon steel.
What is the difference in their roughing cuts in millimeters?

What is the question? _____

What operation (s) is needed? _____

_____

What information do you need from the chart?

_____

Plug in the values. _____

Work the problem _____

Does it seem correct? _____

How do you know?

_____

EXERCISE 3 J & J, electric hammer attachments, NO QUESTIONS AVAILABLE

EXERCISE 4 ABC Millwright program,
NO QUESTIONS AVAILABLE

EXERCISE 5. Steel Pipe Weights

1. Jimmy has standard 1 1/2 inch pipe. He has 150 feet of it. What does it weigh?

What is the question? _____

What operation (s) is needed? _____

_____

What information do you need from the chart?

_____

Plug in the values. _____

Work the problem _____

Does it seem correct? _____

How do you know?

_____

2. Jimmy has 2 inch pipe. He has both standard and extra strong pipe. He has 330 feet of each. What is the difference in their weights?

What is the question? _____

What operation (s) is needed? _____

_____

What information do you need from the chart?

_____

Plug in the values. _____

Work the problem _____

Does it seem correct? _____

How do you know?

_____

3. Jimmy orders 100 feet of 3/8 inch pipe. He ordered standard pipe. The pipe he got weighed 740 pounds. He thinks he got the wrong pipe. What pipe did he get?

What is the question? _____

What operation (s) is needed? _____

_____

What information do you need from the chart?

_____

Plug in the values. _____

Work the problem _____

Does it seem correct? _____

How do you know?

_____

4. **Jimmy rigged a load for 1800 pounds. He must load 1000 feet of 2 1/2 inch standard pipe. What is the difference in the load capacity and the weight of the pipe?**

What is the question? _____

What operation (s) is needed? _____

_____

What information do you need from the chart?

_____

Plug in the values. _____

Work the problem _____

Does it seem correct? _____

How do you know?

_____

5. Jimmy has 180 feet of 3/8 inch standard pipe. What is its total weight?

What is the question? _____

What operation (s) is needed? _____

_____

What information do you need from the chart?

_____

Plug in the values. _____

Work the problem _____

Does it seem correct? _____

How do you know?

_____

6. Jimmy has 50 feet of 1/8 inch pipe. He has 90 feet of 1 inch pipe. He has 61 feet of 2 inch pipe. He has 135 feet of 3/4 inch pipe. All the pipe except the 2 inch pipe is standard pipe. What is the total weight?

What is the question? _____

What operation (s) is needed? _____

_____

What information do you need from the chart?

_____

Plug in the values. _____

Work the problem _____

Does it seem correct? _____

How do you know?

_____

7. **Jimmy has 190 feet of extra strong pipe. It is 1 1/2 inch pipe. He also has 83 feet of 2 1/2 inch pipe. It is standard pipe. Which weighs more?**

What is the question? _____

What operation (s) is needed? _____

_____

What information do you need from the chart?

_____

Plug in the values. _____

Work the problem _____

Does it seem correct? _____

How do you know?

_____ _____

8. Jimmy has 100 feet of each size of extra strong pipe. What is the total weight of the pipe?

What is the question? _____

What operation (s) is needed? _____

_____

What information do you need from the chart?

_____

Plug in the values. _____

Work the problem _____

Does it seem correct? _____

How do you know?

_____

9. Jimmy has a load of 120 feet of 1/4 inch extra strong pipe. He also has 185 feet of 1/2 inch standard pipe. What is the total weight of the load?

What is the question? _____

What operation (s) is needed? _____

_____

What information do you need from the chart?

_____

Plug in the values. _____

Work the problem _____

Does it seem correct? _____

How do you know?

_____

10. Jimmy's crew tells him that their load weighs 217 pounds. The load consists of 100 feet of pipe.

What size pipe is it?

What is the question? _____

What operation (s) is needed? _____

_____

What information do you need from the chart?

_____

Plug in the values. _____

Work the problem _____

Does it seem correct? _____

How do you know?

_____

EXERCISE 6. Weights of Common Materials

1. **Jimmy's crew is moving wood. They have 20 cubic feet of Ash. They have an equal amount of Cedar. What is the difference in the weights?**

What is the question? _____

What operation (s) is needed? _____

_____

What information do you need from the chart?

_____

Plug in the values. _____

Work the problem _____

Does it seem correct? _____

How do you know?

_____

2. **Jimmy has 100 cubic feet of hard solid coal. What is its weight?**

What is the question? _____

What operation (s) is needed? _____

_____

What information do you need from the chart?

_____

Plug in the values. _____

Work the problem _____

Does it seem correct? _____

How do you know?

_____

3. Jimmy has 5 cubic feet of sandstone. He has 29 cubic feet of shale. He has 3 cubic feet of trap rock. What is the total weight?

What is the question? _____

What operation (s) is needed? _____

_____

What information do you need from the chart?

_____

Plug in the values. _____

Work the problem _____

Does it seem correct? _____

How do you know?

_____

4. **Jimmy has one-half of a cubic foot of cast iron. What is its weight?**

What is the question? _____

What operation (s) is needed? _____

_____

What information do you need from the chart?

_____

Plug in the values. _____

Work the problem _____

Does it seem correct? _____

How do you know?

_____

5. Jimmy has 78 cubic feet of common brick. He will use 35 feet of it. What is the weight of the remaining brick?

What is the question? _____

What operation (s) is needed? _____

_____

What information do you need from the chart?

_____

Plug in the values. _____

Work the problem _____

Does it seem correct? _____

How do you know?

_____

6. Jimmy compares the weights of wood. What is the difference in pounds per cubic foot of the heaviest and lightest wood?

What is the question? _____

What operation (s) is needed? _____

_____

What information do you need from the chart?

_____

Plug in the values. _____

Work the problem _____

Does it seem correct? _____

How do you know?

_____

7. Jimmy has one-tenth of a cubic foot of cast copper. What is its weight?

What is the question? _____

What operation (s) is needed? _____

_____

What information do you need from the chart?

_____

Plug in the values. _____

Work the problem _____

Does it seem correct? _____

How do you know?

_____

8. **Jimmy is comparing weights of metals. What is the difference between the heaviest and lightest metal in pounds per cubic foot?**

What is the question? _____

What operation (s) is needed? _____

_____

What information do you need from the chart?

_____

Plug in the values. _____

Work the problem _____

Does it seem correct? _____

How do you know?

_____

9. Jimmy rigs a load for moving marble. He must move 28 cubic feet. He rigs the load for 5000 pounds. What is the difference in the weight of the marble and the load capacity?

What is the question? _____

What operation (s) is needed? _____

_____

What information do you need from the chart?

_____

Plug in the values. _____

Work the problem _____

Does it seem correct? _____

How do you know?

_____

10. Jimmy has 1/2 cubic foot of terra-cotta. He has 1/3 cubic foot of pressed brick. He has 1/4 cubic foot of marble. What is the total weight of these materials? What is the question?

_____

What operation (s) is needed? _____

_____

What information do you need from the chart?

_____

Plug in the values. _____

Work the problem _____

Does it seem correct? _____

How do you know?

_____

EXERICSE 7 Identification Tags,
NO QUESTIONS AVAILABLE.

EXERCISE 8. Keith, metric conversion

1. Keith has 89 ounces of lead. What is the equivalent in grams?

What is the question? _____

What operation (s) is needed? _____

_____

What information do you need from the chart?

_____

Plug in the values. _____

Work the problem _____

Does it seem correct? _____

How do you know?

_____

2. Keith has 9 cubic yards of coal. What does that equal in cubic meters?

What is the question? _____

What operation (s) is needed? _____

_____

What information do you need from the chart?

_____

Plug in the values. _____

Work the problem _____

Does it seem correct? _____

How do you know?

_____

3. Keith has 677 yards of pipe. What does that equal in meters?

What is the question? _____

What operation (s) is needed? _____

_____

What information do you need from the chart?

_____

Plug in the values. _____

Work the problem _____

Does it seem correct? _____

How do you know?

_____

4. **The temperature of a substance is 144 degrees Celsius. What does that equal on the Fahrenheit scale?**

What is the question? _____

What operation (s) is needed? _____

_____

What information do you need from the chart?

_____

Plug in the values. _____

Work the problem _____

Does it seem correct? _____

How do you know?

_____

5. Keith has 650 gallons of styrene. What does that equal in liters?

What is the question? _____

What operation (s) is needed? _____

_____

What information do you need from the chart?

_____

Plug in the values. _____

Work the problem _____

Does it seem correct? _____

How do you know?

_____

6. Keith has 12 metric tons of steel. What is the weight in tons?

What is the question? _____

What operation (s) is needed? _____

_____

What information do you need from the chart?

_____

Plug in the values. _____

Work the problem _____

Does it seem correct? _____

How do you know?

_____

7. Keith has 14 cubic feet of limestone. What does that equal in cubic meters?

What is the question? _____

What operation (s) is needed? _____

_____

What information do you need from the chart?

_____

Plug in the values. _____

Work the problem _____

Does it seem correct? _____

How do you know?

_____

8. Keith has 91 grams of mercury. What does that equal in ounces?

What is the question? _____

What operation (s) is needed? _____

_____

What information do you need from the chart?

_____

Plug in the values. _____

Work the problem _____

Does it seem correct? _____

How do you know?

_____

9. Keith orders 82 liters of a solvent. What will that equal in gallons?

What is the question? _____

What operation (s) is needed? _____

_____

What information do you need from the chart?

_____

Plug in the values. _____

Work the problem _____

Does it seem correct? _____

How do you know?

_____

10. Keith is moving pipe. He knows it weighs 6000 kilograms. What is the weight in pounds?

What is the question? _____

What operation (s) is needed? _____

_____

What information do you need from the chart?

_____

Plug in the values. _____

Work the problem _____

Does it seem correct? _____

How do you know?

_____

EXERCISE 9 Blueprint Abbreviations,
NO QUESTIONS AVAILABLE.

EXERCISE 10. Field Sketches,
NO QUESTIONS AVAILABLE.